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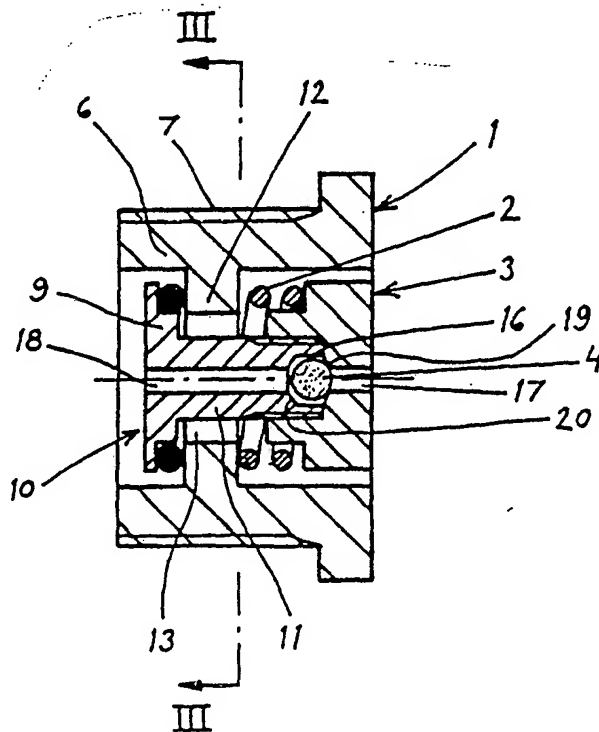
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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: <b>ARTIFICIAL LIMB VALVE</b>		

## (57) Abstract

A valve for an artificial limb, which is retained in place by partial vacuum, comprising a valve body (6) fastened in the artificial limb and a valve cone (10) located in the valve body for discharging air from the artificial limb (A) at the application of the same. In order to prevent suction sores, from which carriers of artificial limbs retained by partial vacuum often suffer, in the valve cone (10) of the valve a valve member (4) is provided, which communicates both with the inside and outside of the valve, and which in response to pressure variations on the inside (D) of the valve moves between two seats (19, 20) located relatively close to each other in a space (16) adjusted in respect of the size of the valve member for air exchange of the space of the artificial limb inside of the valve.



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Artificial limb valve

This invention relates to a valve for artificial limbs, which are retained in place by partial vacuum. Such valves are known previously and located in the artificial limb in order at the application of the artificial limb on an amputated limb to permit the air in the artificial limb beneath the limb to penetrate out and thereafter to maintain the partial vacuum within the artificial limb required for retaining the same.

It was found, however, that retaining of artificial limbs by means of partial vacuum involves problems for the artificial limb carriers, in that they often suffer from suction sores, which can be so tiring that it is a torment to carry the artificial limb.

The present invention, therefore, has the object to eliminate this problem and, more precisely, to provide an artificial limb valve of such a nature as to render possible continuous ventilation of the artificial limb without causing loss of the partial vacuum required for retaining the artificial limb.

This object is achieved in that the valve according to the present invention has the characterizing features defined in the attached claims.

The present invention is described in greater detail in the following with reference to the accompanying drawing, in which Fig. 1 is a schematic and partially sectional view of an artificial leg provided with a valve according to the invention, Fig. 2 is an axial section through the valve proper, and Fig. 3 is a section along the line III-III in Fig. 2.

In the drawing, A designates an artificial limb, which is shown to be an artificial leg for a left leg amputated above the knee. The artificial limb is designed



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with a hollow shank portion B, the internal shape of which corresponds to the shape of the limb, i.e. in the present example the leg, for which the artificial limb is intended, and into which the leg is pressed down for applying the artificial limb. When the artificial limb is pressed onto the leg, the air within the hollow shank portion B is pressed out through an opening C in the lower portion of the shank B of the artificial limb, whereby a partial vacuum is obtained which is sufficient for retaining the artificial limb A on the leg.

In order to maintain this partial vacuum, the artificial limb A is provided in the opening C with a valve 1 according to the invention, which valve is attached detachably, for example screwn, in the opening C. The valve 1 comprises a sleeve-shaped valve body 6 with external thread 7 for securing the valve in the opening C of the artificial limb and an external supporting flange 8 for abutting the outer surface of the artificial limb when the valve is applied, further a valve cone 10 assembled of a sealing portion 9 and a control portion 3, which cone by a shaft 11 connecting the sealing portion 9 and control portion 3 relative to each other extends through an annular seat portion 12 in the valve body 6, which seat portion has an inner diameter smaller than the valve body in general and includes in its inward facing surface 14 a number of diametrically formed depressions 13. The seat portion 12 owing to its configuration also serves as a slide guide for the shaft 11 of the valve cone.

Between the seat portion 12 and control portion 3, which at the embodiment shown in the drawing is screwn onto the shaft 11 formed integral with the sealing portion 9, a compression spring 2 is clamped, which holds the sealing portion 9 provided with an annular sealing member 15 in sealing abutment to one side of the annul-



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ar seat portion, so that air is prevented from passing through the valve 1 in either direction. By actuating the control portion 3 of the valve, for example manually, with a force exceeding the force exercised by the spring 2, the sealing portion is moved from its seat, and air is allowed to pass through the valve in both directions.

The present valve further comprises a valve ball 4, which with accurately adjusted clearance is freely movable in a substantially cylindric space 16 in the valve cone 10. This space, which has a diameter exceeding only slightly the diameter of the valve ball 4, communicates with the outer surface of the valve, i.e. the atmosphere, through a passageway 17 formed in the valve cone 10, more precisely in the control portion 3 thereof, and with the inside of the valve, i.e. with the space D of the artificial limb beneath the leg, through a passageway 18 formed in the valve cone 10, more precisely in the sealing portion 9 and shaft 11 thereof, which passageway aligns with the passageway 17. About this passageway and about the passageway 18, in the opposed sides of the space a seat 19 and, respectively, 20 for the valve ball 4 are formed, which seats are located at a distance from each other which is only slightly greater than the diameter of the valve ball and between which seats the valve ball 4 can move freely in its space 16 to be caused to seal against either the seat 19 or against the seat 20.

The valve 1 according to the present invention operates as follows. At the application of the artificial limb A the control portion 3 of the valve is held depressed manually at the same time as the artificial limb A is pressed onto the leg, whereafter the valve 1 is closed by releasing the control portion 3, whereby the sealing portion 9 is moved by the spring 2 to sealing abutment



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to its seat surface on seat portion 12 of the valve body. Due to the fact that the valve 1 during the pressing of the artificial limb on the leg is open, the air in front of the leg in the artificial limb is pressed out through the valve, and the partial vacuum thereby arising within the artificial limb A is fully sufficient to retain the artificial limb A in place.

As soon as this partial vacuum arises, the valve ball 4 automatically is caused to seal against its seat 20 and the partial vacuum is maintained in the space D in the artificial limb A. When the artificial limb carrier moves, a pulsating pressure within the space D of the artificial limb arises, i.e. a pressure which increases when the artificial leg is loaded and which decreases when the artificial leg is relieved. When the pressure in the space D increases, the valve ball 4 is moved to abut its seat 19, and during this movement of the valve ball a small amount of air is permitted to flow out from the space, and when the artificial leg then is relieved, the pressure in the space D of the artificial limb again drops, whereby the valve ball 4 is returned to its seat 20 and seals against the same. During this movement of the valve ball 4 a small amount of fresh air is sucked into the space of the artificial limb. With other words, the valve ball 4 in response to pressure variations arising in the space D of the artificial limb will seal alternately against its seats 19 and 20, whereby a certain ventilation of the space D in the artificial limb is obtained, or with other words, the leg enclosed in the artificial limb is given the opportunity of breathing. The amount of air permitted to flow out from and, respectively, into the space D is determined by the clearance for the valve ball in its space, and this clearance is ad-



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justed so that the amount of air permitted to flow past the valve ball 4 is not greater than required for maintaining the partial vacuum necessary for retaining the artificial limb. This breathing rendered possible by the valve according to the present invention is sufficient for preventing suction sores, from which carriers of artificial limbs so often suffer.



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Claims

1. A valve for an artificial limb retained in place by partial vacuum, comprising a valve body (6) fastened in the artificial limb and a valve cone (10) located in said valve body for discharging air from the artificial limb (A) at the application thereof, characterized in that in the valve cone (10) of the valve a valve member (4) is located, which communicates both with the inside and outside of the valve and in response to pressure variations on the inside (D) of the valve moves between two seats (19,20) located relatively close to each other in a space (16) adjusted in respect of the size of the valve member for air exchange of the space of the artificial limb inside of the valve.
2. A valve as defined in claim 1, characterized in that the valve member has the shape of a ball (4), and that its two seats (19,20) are located at a distance from each other which is only slightly greater than the diameter of the ball.
3. A valve as defined in claim 2, characterized in that the space (16), in which the ball-shaped valve member (4) is located, is cylindric with a diameter only slightly greater than that of the ball.
4. A valve as defined in any one of the preceding claims, characterized in that the connection between the valve member (4) and the inside and outside of the valve consists of passageways (17, 18), which are located in the valve cone (10) aligning with each other, which passageways open concentrically in relation each to its seat (19,20) in the space (16) of the valve member.





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5. A valve as defined in any one of the preceding claims, characterized in that the valve cone (10) movable in the valve body, in which cone the valve member (4) is located, consists of a sealing portion (9) sealing against an annular valve seat (12) in the valve body and of a control portion (3) connected to the sealing portion (9) and actuated by a spring (2) for maintaining the sealing portion (9) in abutment to its seat (12).

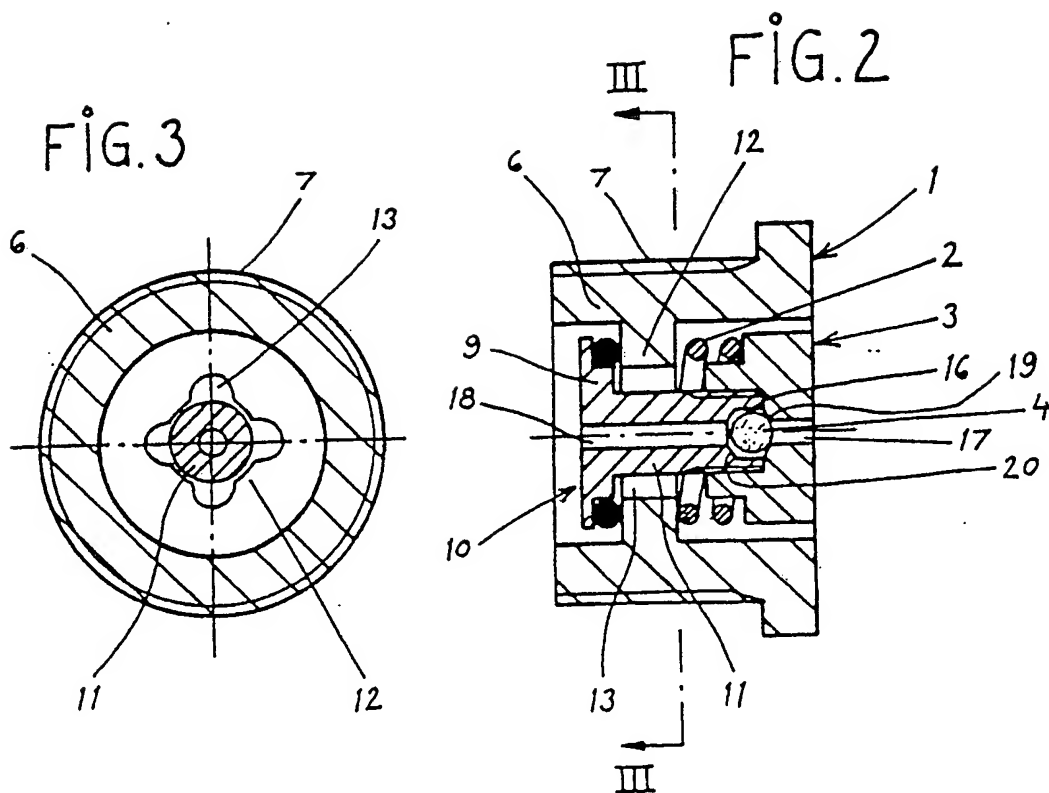
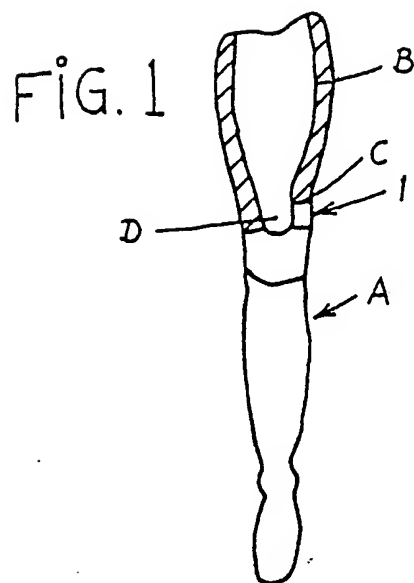
6. A valve as defined in claim 5, characterized in that the control portion (3) of the valve cone is detachably connected to the sealing portion (9) of the valve cone, and that the space (16) of the valve member is formed in the portions of said portions facing to each other.



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## INTERNATIONAL SEARCH REPORT

International Application No. PCT/SE83/00318

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>1</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC <sup>3</sup>		
A 61 F 1/02		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>4</sup>		
Classification System	Classification Symbols	
IPC 3 US C1	A 61 F 1/00,02,08 3: 17, 18	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched <sup>5</sup>		
SE, NO, DK, FI classes as above		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>		
Category <sup>8</sup>	Citation of Document, <sup>15</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>14</sup>
X	DE, C, 650 858 (WEBER & GREISSINGER) 16 September 1937	1-6
A	DE, C, 746 781 (JOHANN GIRTEN) 23 August 1944	1,4,5
A	DE, A, 2 729 800 (WALTER SURERUS) 4 January 1979	1,4-6
A	US, A, 2 696 011 (J GALDIK) 7 December 1954	1,4,5
<p><sup>8</sup> Special categories of cited documents: <sup>13</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search <sup>1</sup>		Date of Mailing of this International Search Report <sup>1</sup>
1983-11-30		1983-12-07
International Searching Authority <sup>1</sup>		Signature of Authorized Officer <sup>13</sup>
Swedish Patent Office		Leif Karnsäter